The Heaviside Centenary Meeting

Nearly 400 members and their guests attended the meeting which was held during the afternoon and evening of the 18th May, 1950, to celebrate the centenary of the birth of Oliver Heaviside which fell on that day, and for the occasion the President, Prof. E. B. Moullin, was supported by Sir Robert Robinson, President of The Royal Society, of which Heaviside had been a Fellow. Amongst those who had been specially invited to attend were a number of Heaviside's relations; the Mayor and Mayoress of St. Pancras, the Borough in which he was born; and the Mayor of Torquay, where he spent his later years.

In opening the meeting, the President dwelt on the debt which all those who had benefited by his work owed to Heaviside for his efforts towards the greater understanding of science, although in many instances Heaviside's mode of expression did not make the process of understanding a simple one.

Sir Robert Robinson remarked on the way in which Heaviside had demonstrated the interdependence of pure and technical science, and drew a parallel between him and Sir Isaac Newton; each had tended to work alone and neither had published all that he had discovered.

Sir George Lee, a Past-President of The Institution, then presented his paper, "Oliver Heaviside—the Man," which was the main item of the afternoon's proceedings. The paper gave a vivid picture of the personal side of Heaviside's life and included extracts from some of his letters, and accounts of those who had known him intimately. Heaviside deprecated the too liberal distribution of honours, and accepted those which came to him during his later years only when he was convinced that they were justified. In his own words "The more honours, the less value. It is depreciating the currency."

Sir Edward Appleton, Principal and Vice-Chancellor of Edinburgh University, then described the work that Heaviside had carried out on the propagation of electromagnetic waves, and in passing told a story of Heaviside's attitude regarding the complexity of some of his papers. Someone once said to him, "You know, Mr. Heaviside, your papers are very difficult indeed to read"; Heaviside's reply was, "That may well be, but they were much more difficult to write." In his article for the 10th edition of the Encyclopaedia Britannica, which was published in 1902, Heaviside had discussed the transmission of radio waves and had suggested the possibility of a conducting layer above the earth which, taken in conjunction with the surface of the earth, would conduct radio waves in the form of a kind of waveguide. Sir Edward then went on to describe the series of experiments which had been carried out by himself, Dr. van der Pol, Dr. W. H. Eccles and others to prove this theory.

In introducing Dr. M. J. H. Ponte, who was representing the Société Française des Électriciens, the Société des Radio-électriciens and other societies in France, the President mentioned that these French bodies were celebrating Heaviside's centenary in Paris, and that Sir Edward Appleton and Prof. Willis Jackson were to be present to represent The Royal Society and The Institution. Dr. Ponte gave further instances of the genius of Oliver Heaviside, particularly with regard to pure mathematics, and spoke of his remarkable gift of intuition. His methods were unorthodox and were not well received by those mathematicians who demanded rigorous proofs.

Sir Archibald Gill then described Heaviside's work in connection with the inductive loading of telephone lines as a method of decreasing the attenuation of the upper frequencies in the audible range. The suggestion had not been well received in this country, and the Americans had been the first to put it into practice; Sir Archibald described how Pupin had successfully loaded a line with uniformly spaced inductance coils.

The next contribution to the proceedings came in what Sir Stanley Angwin later described as "potted form"; it was a recording which had been made by Dr. O. E. Buckley, the President of the Bell Telephone Laboratories, in which he expressed American appreciation of Heaviside's work and the high esteem in which it was held in America. He described Heaviside's conception of the loading of telephone lines as one of the great milestones of telephony.

Further proof of Heaviside's genius was given in a contribution by Prof. Harold Jeffreys, Plumian Professor of Astronomy and Experimental Philosophy at Cambridge, which described the intricacies of Heaviside's use of the definite integration operator p^{-1}. Heaviside used p to indicate differentiation and treated both p and p^{-1} as though they were numbers, a system which necessarily has its limitations and requires careful handling. Prof. Jeffreys unfortunately could not be present at the meeting, and his contribution was read by the President.

The mathematician's point of view was further expounded by Sir Edmund Whittaker, Emeritus Professor of Physics at Edinburgh, who dealt in more general terms with Heaviside's contribution to the subject. Sir Edmund spoke of Heaviside's ability to perceive mathematical results of a high order of complexity without the need of rigorous proofs, a gift which inevitably tended to make him contemptuous of formal logic. Rigorous proofs of Heaviside's results were later established, so justifying the use he made of his operational calculus. As Sir Edmund pointed out, he was perhaps above all a man who was entitled to take as his motto "First get on, in any way possible, and let the logic be left for later work"—a principle with which Einstein has since agreed.

Apart from Sir George Lee's paper, the proceedings had so far been taken up with the scientific side of Heaviside's life and close attention was therefore paid to Dr. G. F. C. Searle, who had been a lecturer in Experimental Physics at Cambridge and who was the only contributor to the day's proceedings who had known Heaviside personally, when he gave details of the more intimate side of Heaviside's domestic life. Both the subject-matter and the way in which it was presented were pleasantly informal, and the audience were given details of Heaviside's home life, both at Newton Abbot, where he had first settled, and later at Torquay, where he died in February, 1925.

The meeting then adjourned for tea.

In opening the evening session, the President outlined the history of The Institution's purchase, after the First World War, of some papers and notebooks in which Heaviside had recorded most of his mathematical work. These brought to light much material which had never been published, some of which had probably been intended for the fourth volume of Heaviside's "Electromagnetic Theory."

The President thanked Mr. H. J. Josephs for studying these papers and assembling them in a logical form, and then called upon him to give a brief exposition of his paper on "Some Unpublished Notes of Oliver Heaviside."

Mr. Josephs dealt with the more abstruse aspects of Heaviside's work in which he had concerned himself, amongst other things, with the invariances associated with the interaction of subatomic fields; it was in this connection that he had developed a new algebra of operational quaternions. The notes revealed that Heaviside had intended, in the fourth volume of "Electromagnetic Theory" to develop a unified theory in which electromagnetism would be correlated with the atomic structure of mass properties and gravitation; his ideas on the subject have recently been confirmed by Einstein.

Prof. Willis Jackson then spoke of Heaviside's contribution to electromagnetic theory. A prolific writer, between 1872 and 1902 Heaviside had published some one and a half million

words. In connection with telegraph and telephone line theory he had developed the now familiar line equations which include terms for the inductance, capacitance and resistance of the line, and had deduced that the current travelled along the line with constant velocity equal to $1/\sqrt{(LC)}$. It was Heaviside who first expressed Maxwell's equations in terms of the electric and magnetic field intensities, the form in which they are now most generally used. In research of this nature it is inevitable that the work of one investigator should overlap that of another, and Prof. Jackson paid tribute to the scrupulous manner in which Heaviside acknowledged the priority of other men's efforts. He then spoke of various other aspects of Heaviside's work, including a treatise he had written on what was in essence a cylindrical waveguide, and his work on the rationalization of units.

Professor Balth. van der Pol, who is well known to members of The Institution, described Heaviside's operational calculus and in passing treated the audience to a truism: "Waves are not recognized by the fact that they oscillate, but by the fact that they propagate . . . the property of waves is that they propagate."

The last paper of the evening was read by Dr. W. G. Radley. His paper was devoted to Heaviside's work on telephone and telegraph transmission, and the proceedings were enlivened by an interesting series of demonstrations. To show the effect of the inductive loading of a line, the Post Office had brought four pairs of wires into the Lecture Theatre, and these were connected via a telephone exchange to the south side of London and then looped back. The circuits were 22 miles in length, one being loaded and the other unloaded. A woman's voice was then transmitted alone each line, and the difference in the attenuation of the upper frequencies of the two received signals made the effects of loading obvious.

In order to show the mode of operation of the Heaviside layer, radiation from a frequency-modulated klystron oscillator, operating on a wavelength of 3 cm, was reflected from a metal sheet, supported in the roof of the Lecture Theatre, and then received at floor level. A "ground wave" was carried between the transmitter and the receiver by a coaxial cable. In this way, Dr. Radley was able to reproduce in miniature Appleton's original experiment for finding the height of the Heaviside layer, and, to prove that there was no deception, he caused the trace on the cathode-ray tube to wobble by swinging the "ionosphere."

At the conclusion of the meeting, Col. Sir A. Stanley Angwin, a Past President, proposed a vote of thanks to those who had contributed papers and organized the celebrations.